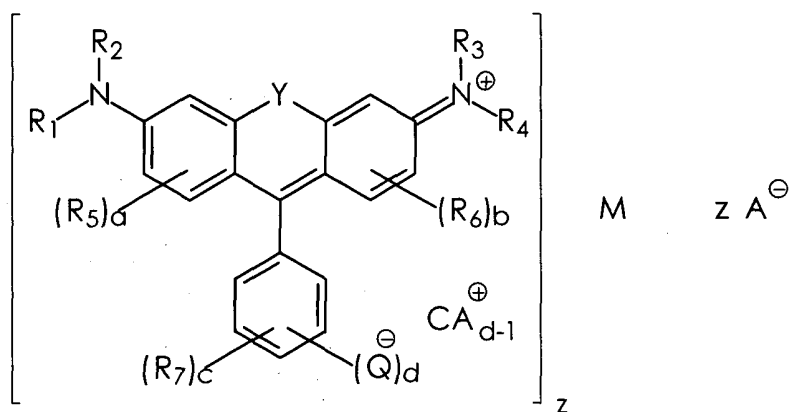
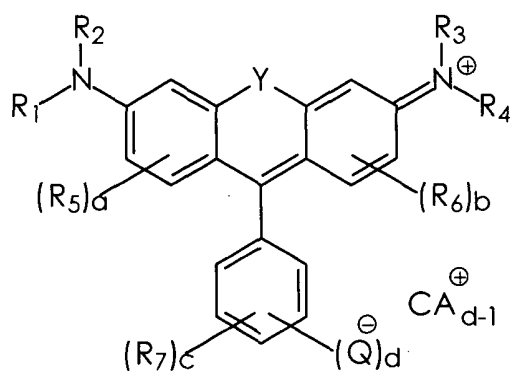


**WHAT IS CLAIMED IS:**

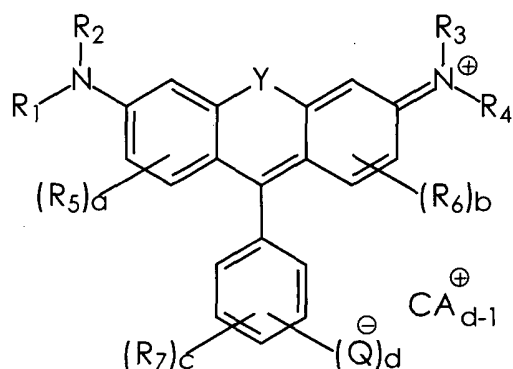
1. A compound of the formula



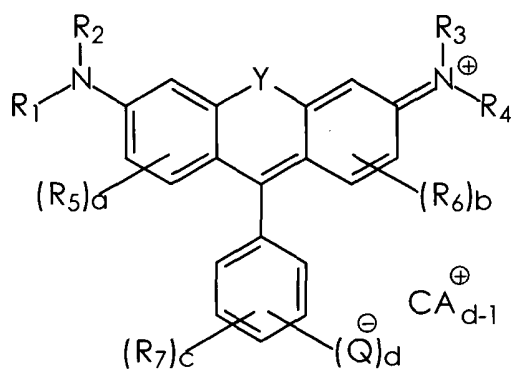
wherein M is either (1) a metal ion having a positive charge of +y wherein y is an integer which is at least 2, said metal ion being capable of forming a compound with at least two



chromogen moieties, or (2) a metal-containing moiety capable of forming a compound with at least two

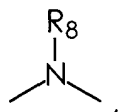
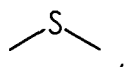
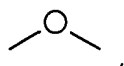


chromogen moieties, z is an integer representing the number of

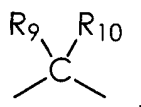


chromogen moieties associated with the metal and is at least 2,  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$  each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, wherein  $R_1$  and  $R_2$  can be joined together to form a ring, wherein  $R_3$  and  $R_4$  can be joined together to form a ring, and wherein  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$  can each be joined to a phenyl ring in the central structure,  $a$  and  $b$  each, independently of the others, is an integer which is 0, 1, 2, or 3,  $c$  is an integer which is 0, 1, 2, 3, or 4, each  $R_5$ ,  $R_6$ , and  $R_7$ , independently of the others, is (i) an alkyl group, (ii) an aryl group, (iii) an arylalkyl group, (iv) an alkylaryl group, (v) a halogen

atom, (vi) an ester group, (vii) an amide group, (viii) a sulfone group, (ix) an amine group or ammonium group, (x) a nitrile group, (xi) a nitro group, (xii) a hydroxy group, (xiii) a cyano group, (xiv) a pyridine or pyridinium group, (xv) an ether group, (xvi) an aldehyde group, (xvii) a ketone group, (xviii) a carbonyl group, (xix) a thiocarbonyl group, (xx) a sulfate group, (xxi) a sulfide group, (xxii) a sulfoxide group, (xxiii) a phosphine or phosphonium group, (xxiv) a phosphate group, (xxv) a mercapto group, (xxvi) a nitroso group, (xxvii) an acyl group, (xxviii) an acid anhydride group, (xxix) an azide group, (xxx) an azo group, (xxxi) a cyanato group, (xxxii) an isocyanato group, (xxxiii) a thiocyanato group, (xxxiv) an isothiocyanato group, (xxxv) a urethane group, or (xxxvi) a urea group, wherein  $R_5$ ,  $R_6$ , and  $R_7$  can each be joined to a phenyl ring in the central structure,



or



$R_8$ ,  $R_9$ , and  $R_{10}$  each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, provided that the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 16,  $Q^-$  is a  $\text{COO}^-$  group

or a  $\text{SO}_3^-$  group,  $d$  is an integer which is 1, 2, 3, 4, or 5,  $A$  is an anion, and  $CA$  is either a hydrogen atom or a cation associated with all but one of the  $Q^-$  groups.

2. A compound according to claim 1 wherein M is a metal ion of a metal selected from magnesium, calcium, strontium, barium, radium, aluminum, gallium, germanium, indium, tin, antimony, tellurium, thallium, lead, bismuth, polonium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, zirconium, niobium molybdenum, technetium, ruthenium, rhodium, palladium, silver, cadmium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, gold, mercury, metals of the lanthanide series, metals of the actinide series, and mixtures thereof.

3. A compound according to claim 1 wherein M is a metal ion of a metal selected from zinc, calcium, bismuth, tin, iron, copper, aluminum, nickel, titanium, chromium, or mixtures thereof.

4. A compound according to claim 1 wherein M is a zinc metal ion.

5. A compound according to claim 1 wherein M is a metal-containing moiety which is a metal ionic moiety.

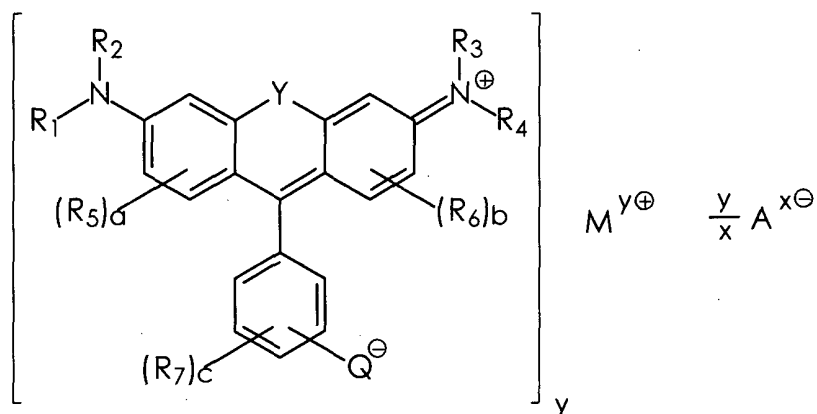
6. A compound according to claim 1 wherein M is a metal-containing moiety which is a metal coordination compound.

7. A compound according to claim 1 wherein M is a metal-containing moiety which is a heteropolyacid.

8. A compound according to claim 7 wherein the heteropolyacid is a phosphotungstic acid, a silicotungstic acid, a phosphomolybdic acid, or a mixture thereof.

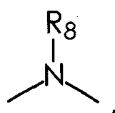
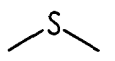
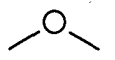
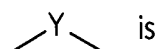
9. A compound according to claim 7 wherein the heteropolyacid is a mixture of phosphomolybdic acid and phosphotungstic acid.

10. A compound of the formula

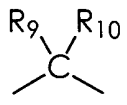


wherein M is a metal cation, y is an integer representing the charge on the metal cation and is at least 2, A is an anion, x is an integer representing the charge on the anion, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, wherein R<sub>1</sub> and R<sub>2</sub> can be joined together to form a ring, wherein R<sub>3</sub> and R<sub>4</sub> can be joined together to form a ring, and wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> can each be joined to a phenyl ring in the central structure, a and b each, independently of the others, is an integer which is 0, 1, 2, or 3, c is an integer which is 0, 1, 2, 3, or 4, each R<sub>5</sub>, R<sub>6</sub>, and R<sub>7</sub>, independently of the others, is (i) an alkyl group, (ii) an aryl group, (iii) an arylalkyl group, (iv) an alkylaryl group, (v) a halogen atom, (vi) an ester group, (vii) an amide group, (viii) a sulfone group, (ix) an amine group or ammonium group, (x) a nitrile group, (xi) a nitro group, (xii) a hydroxy group, (xiii) a cyano group, (xiv) a pyridine or pyridinium group, (xv) an ether group, (xvi) an aldehyde group, (xvii) a ketone group, (xviii) a carbonyl group, (xix) a thiocarbonyl group, (xx) a sulfate group, (xxi) a sulfide group, (xxii) a sulfoxide group, (xxiii) a phosphine or phosphonium group, (xxiv) a phosphate group, (xxv) a mercapto group, (xxvi) a

nitroso group, (xxvii) an acyl group, (xxviii) an acid anhydride group, (xxix) an azide group, (xxx) an azo group, (xxxi) a cyanato group, (xxxii) an isocyanato group, (xxxiii) a thiocyanato group, (xxxiv) an isothiocyanato group, (xxxv) a urethane group, or (xxxvi) a urea group, wherein  $R_5$ ,  $R_6$ , and  $R_7$  can each be joined to a phenyl ring in the central structure,



or



$R_8$ ,  $R_9$ , and  $R_{10}$  each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, provided that the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 16, and  $Q^-$  is a  $COO^-$  group or a  $SO_3^-$  group.



11. A compound according to claim 1 wherein a, b, and c are each zero.

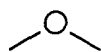
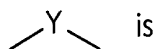
12. A compound according to claim 1 wherein d is 1.

13. A compound according to claim 1 wherein d is 2.

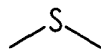
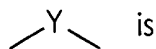
14. A compound according to claim 1 wherein d is 1 and Q is a  $\text{COO}^-$  group.

15. A compound according to claim 1 wherein d is 1 and Q is a  $\text{SO}_3^-$  group.

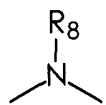
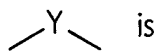
16. A compound according to claim 1 wherein



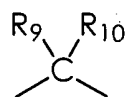
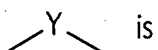
17. A compound according to claim 1 wherein



18. A compound according to claim 1 wherein



19. A compound according to claim 1 wherein



20. A compound according to claim 1 wherein at least one of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> is an alkyl group.

21. A compound according to claim 20 wherein the alkyl group is a linear alkyl group.

22. A compound according to claim 20 wherein the alkyl group is a branched alkyl group.

23. A compound according to claim 20 wherein the alkyl group is a saturated alkyl group.

24. A compound according to claim 20 wherein the alkyl group is an unsaturated alkyl group.

25. A compound according to claim 20 wherein the alkyl group is a cyclic alkyl group.

26. A compound according to claim 20 wherein the alkyl group is a substituted alkyl group.

27. A compound according to claim 20 wherein the alkyl group is an unsubstituted alkyl group.

28. A compound according to claim 20 wherein the alkyl group has at least about 18 carbon atoms.

29. A compound according to claim 20 wherein at least one hetero atom selected from oxygen, nitrogen, sulfur, silicon, or phosphorus is present in the alkyl group.

30. A compound according to claim 20 wherein no hetero atoms are present in the alkyl group.

31. A compound according to claim 1 wherein at least one of  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$  is an aryl group.

32. A compound according to claim 31 wherein the aryl group is a substituted aryl group.

33. A compound according to claim 31 wherein the aryl group is an unsubstituted aryl group.

34. A compound according to claim 31 wherein at least one hetero atom selected from oxygen, nitrogen, sulfur, silicon, or phosphorus is present in the aryl group.

35. A compound according to claim 31 wherein no hetero atoms are present in the aryl group.

36. A compound according to claim 1 wherein at least one of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> is an arylalkyl group.

37. A compound according to claim 36 wherein the arylalkyl group is a substituted arylalkyl group.

38. A compound according to claim 36 wherein the arylalkyl group is an unsubstituted arylalkyl group.

39. A compound according to claim 36 wherein at least one hetero atom selected from oxygen, nitrogen, sulfur, silicon, or phosphorus is present in the arylalkyl group.

40. A compound according to claim 36 wherein no hetero atoms are present in the arylalkyl group.

41. A compound according to claim 1 wherein at least one of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> is an alkylaryl group.

42. A compound according to claim 41 wherein the alkylaryl group is a substituted alkylaryl group.

43. A compound according to claim 41 wherein the alkylaryl group is an unsubstituted alkylaryl group.

44. A compound according to claim 41 wherein at least one hetero atom selected from oxygen, nitrogen, sulfur, silicon, or phosphorus is present in the alkylaryl group.

45. A compound according to claim 41 wherein no hetero atoms are present in the alkylaryl group.

46. A compound according to claim 1 wherein  $R_1$  and  $R_2$  are joined together to form a ring.

47. A compound according to claim 1 wherein  $R_1$  and  $R_2$  are joined together to form a ring and wherein  $R_3$  and  $R_4$  are joined together to form a ring.

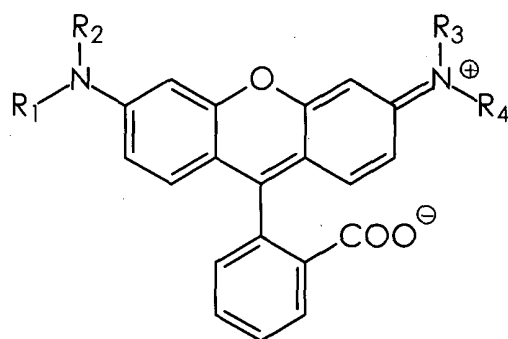
48. A compound according to claim 1 wherein at least one of  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$  is joined to a phenyl ring in the central structure.

49. A compound according to claim 1 wherein the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 32.

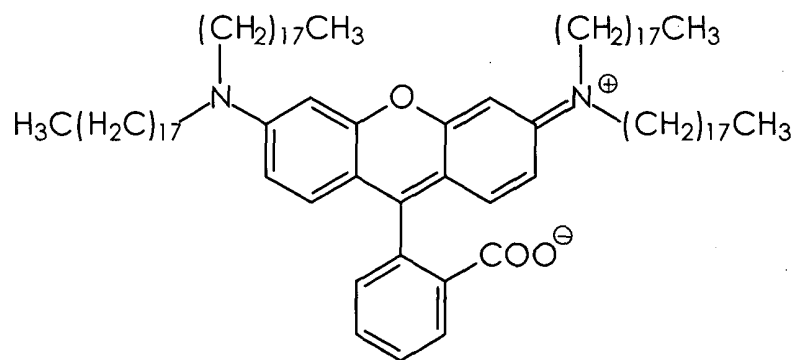
50. A compound according to claim 1 wherein the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 48.

51. A compound according to claim 1 wherein the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 72.

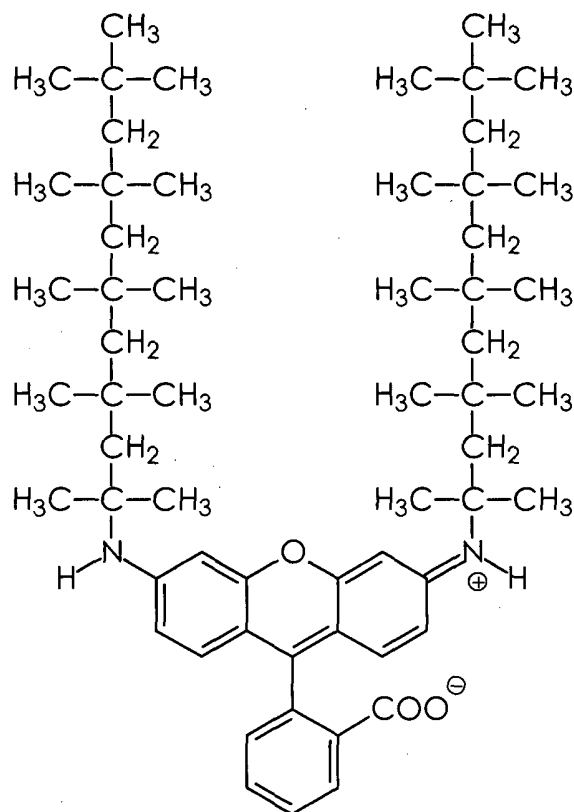
52. A compound according to claim 1 wherein the chromogen is of the formula



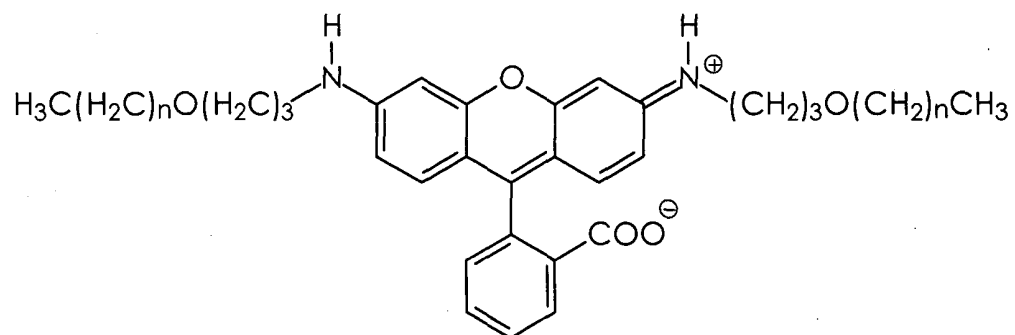
53. A compound according to claim 1 wherein the chromogen is of the formula



54 A compound according to claim 1 wherein the chromogen is of the formula

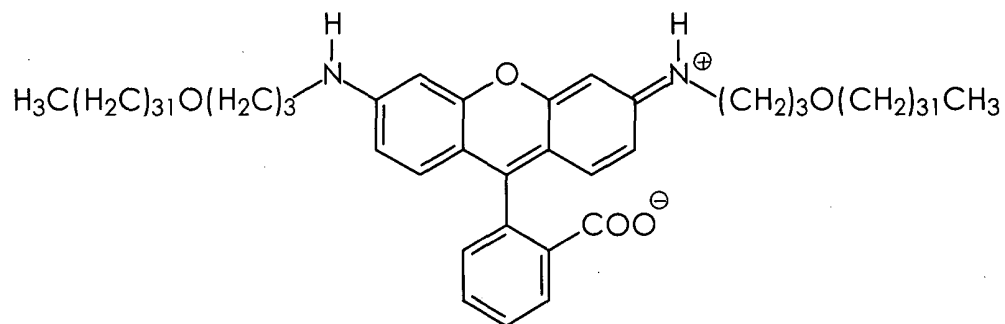


55. A compound according to claim 1 wherein the chromogen is of the formula



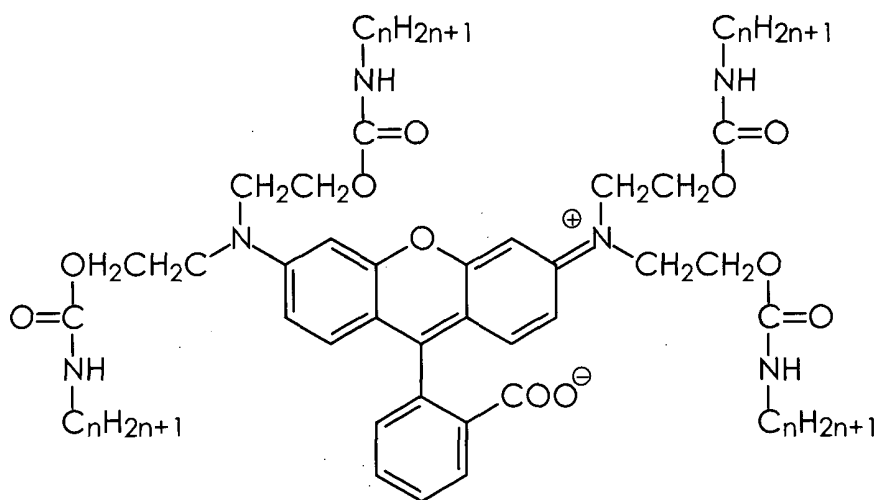
wherein  $n$  is at least about 11.

56. A compound according to claim 1 wherein the chromogen is of the formula



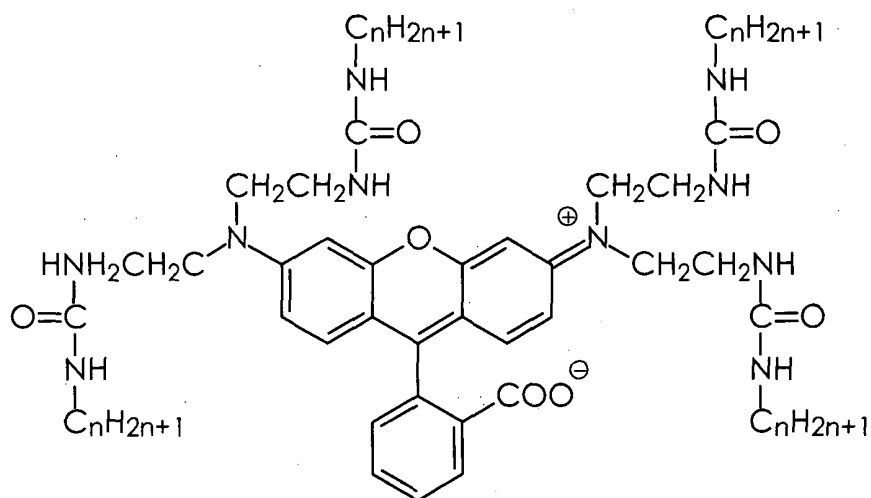


57. A compound according to claim 1 wherein the chromogen is of the formula



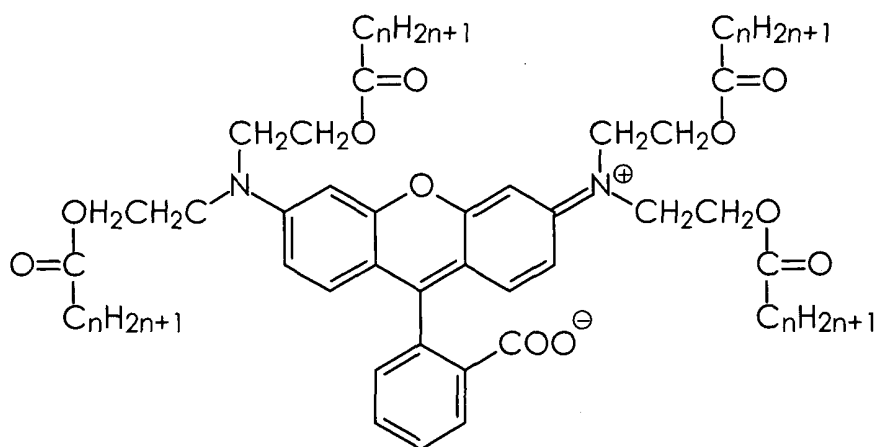
wherein n is at least about 12.

58. A compound according to claim 1 wherein the chromogen is of the formula



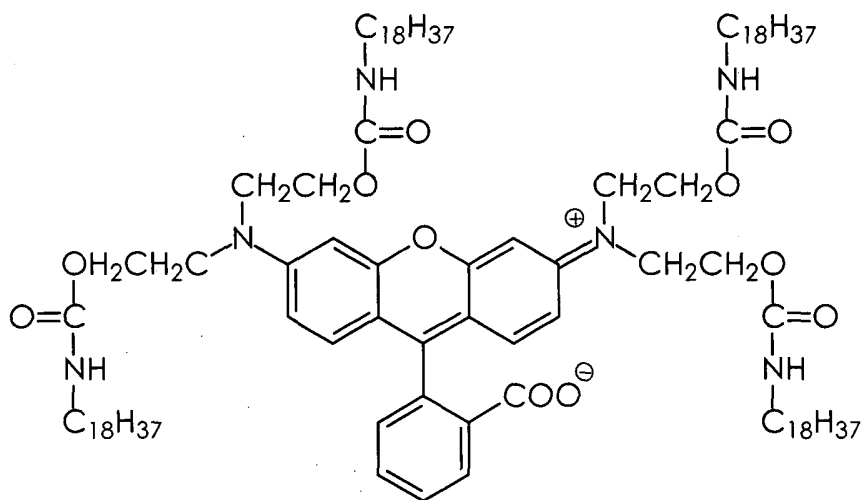
wherein n is at least about 12.

59. A compound according to claim 1 wherein the chromogen is of the formula

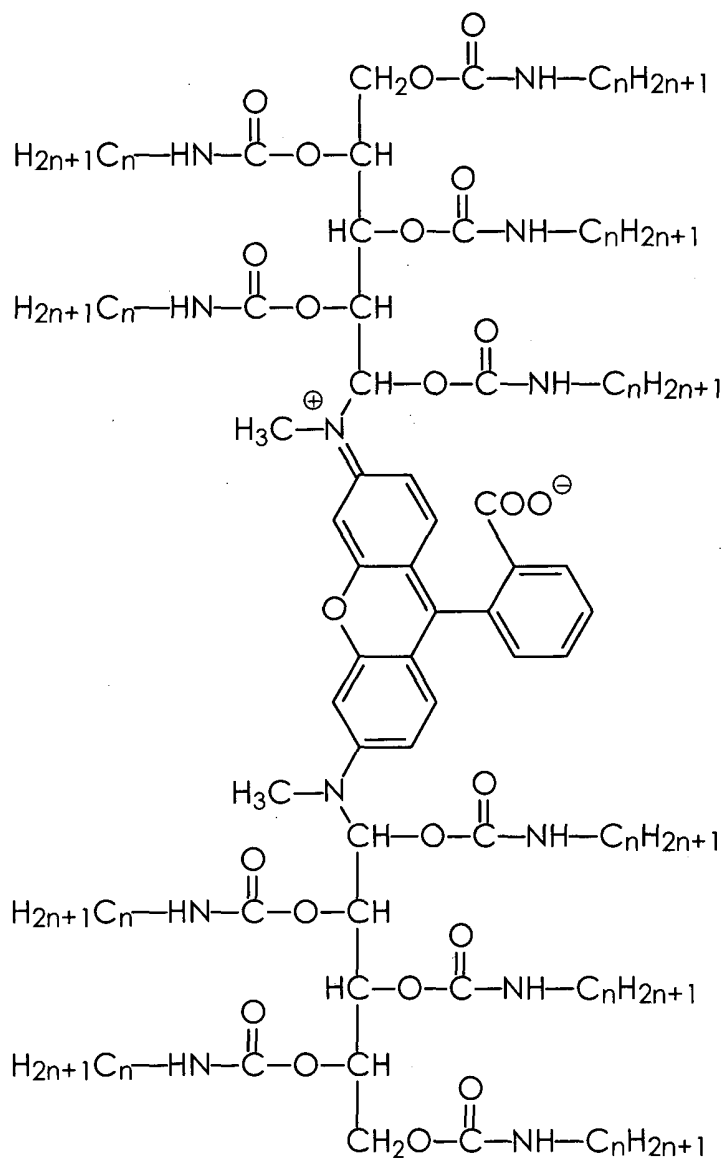


wherein n is at least about 12.

60. A compound according to claim 1 wherein the chromogen is of the formula

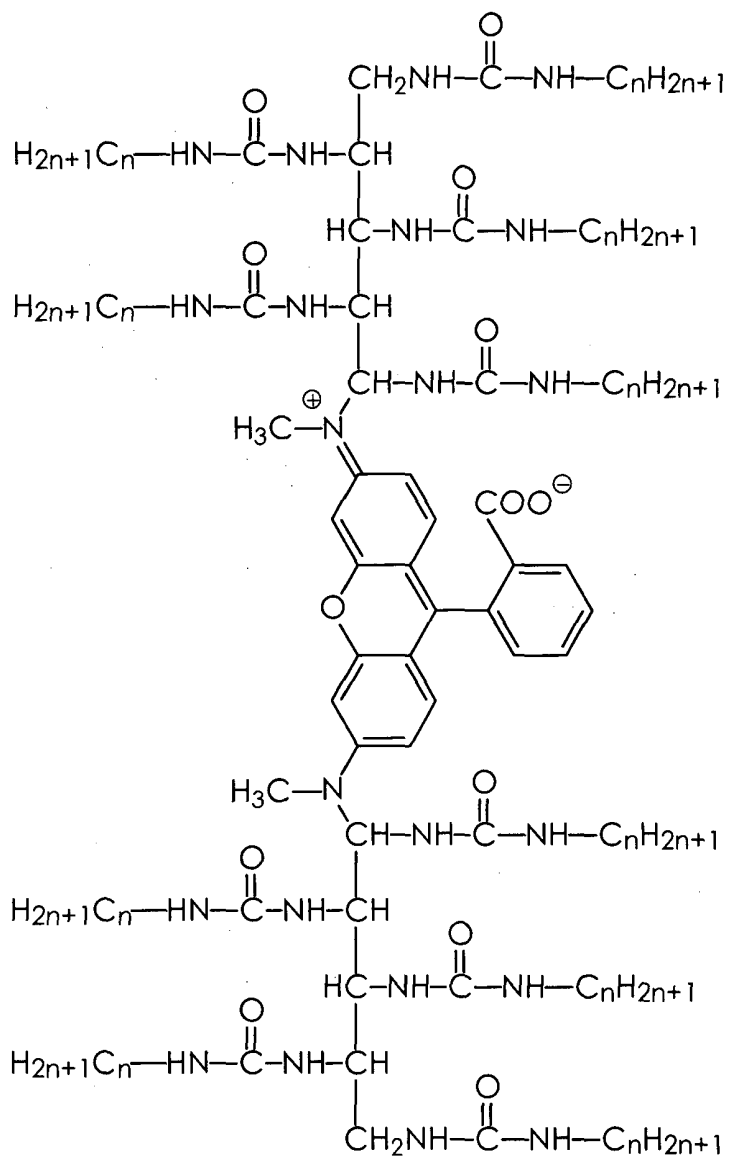


61. A compound according to claim 1 wherein the chromogen is of the formula



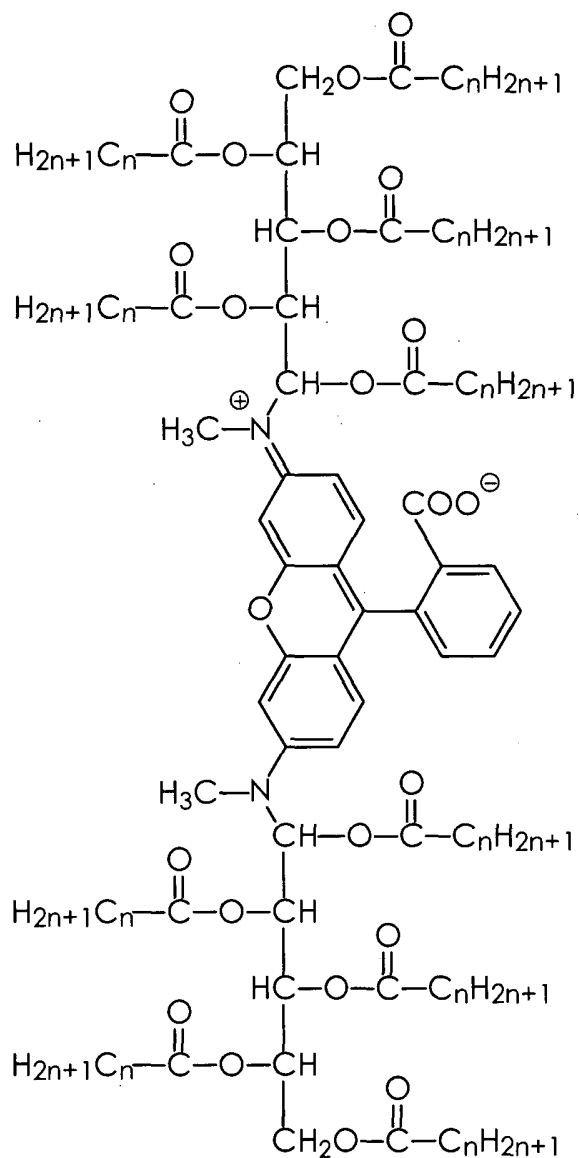
wherein n is at least about 12.

62. A compound according to claim 1 wherein the chromogen is of the formula



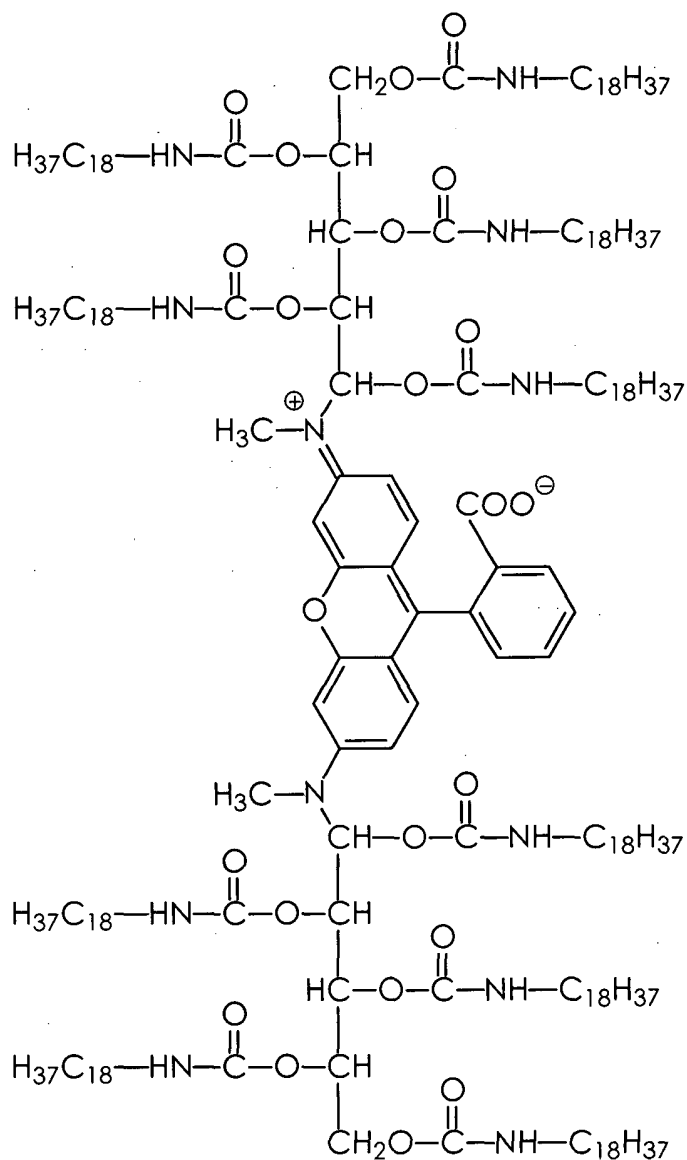
wherein n is at least about 12.

63. A compound according to claim 1 wherein the chromogen is of the formula

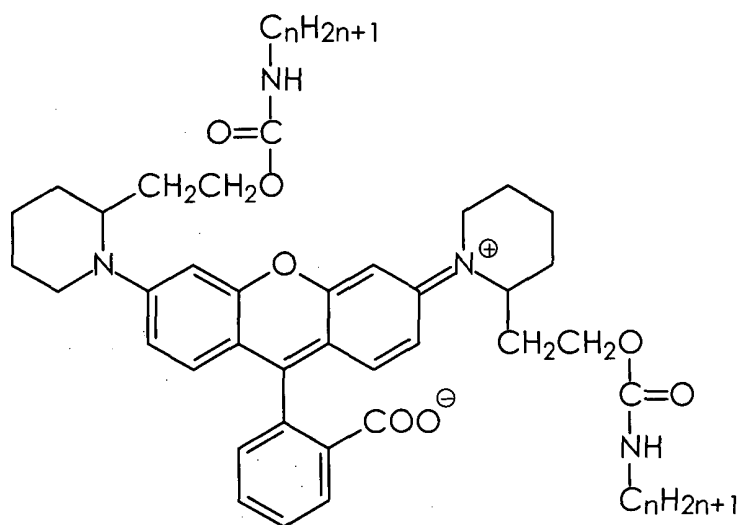


wherein n is at least about 12.

64. A compound according to claim 1 wherein the chromogen is of the formula



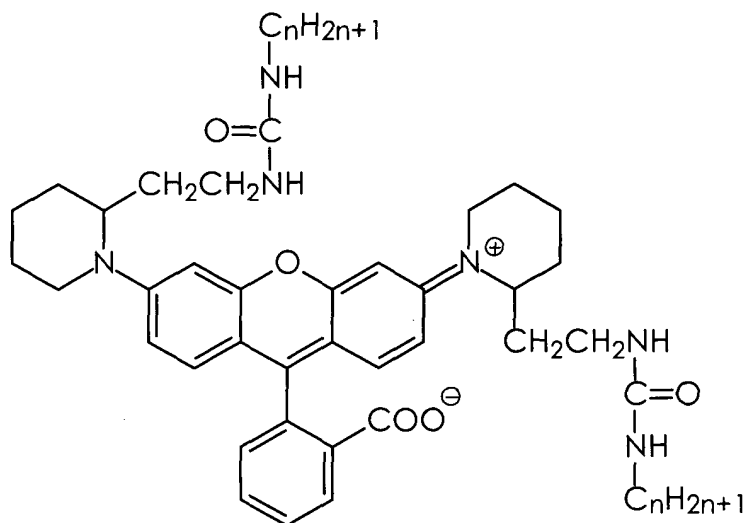
65. A compound according to claim 1 wherein the chromogen is of the formula



wherein n is at least about 12.

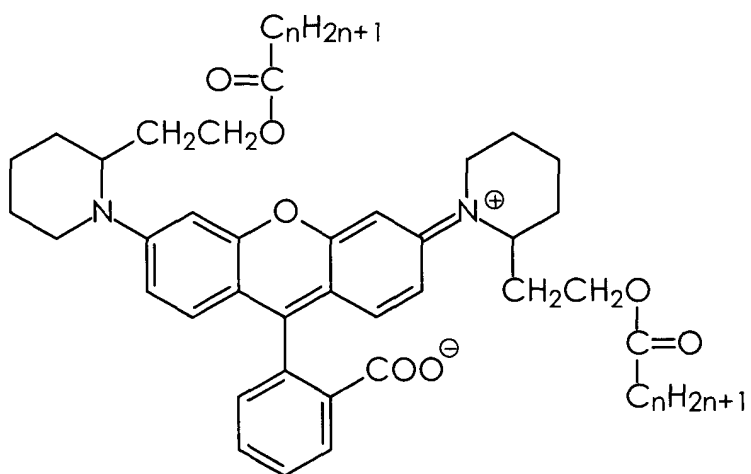


66. A compound according to claim 1 wherein the chromogen is of the formula



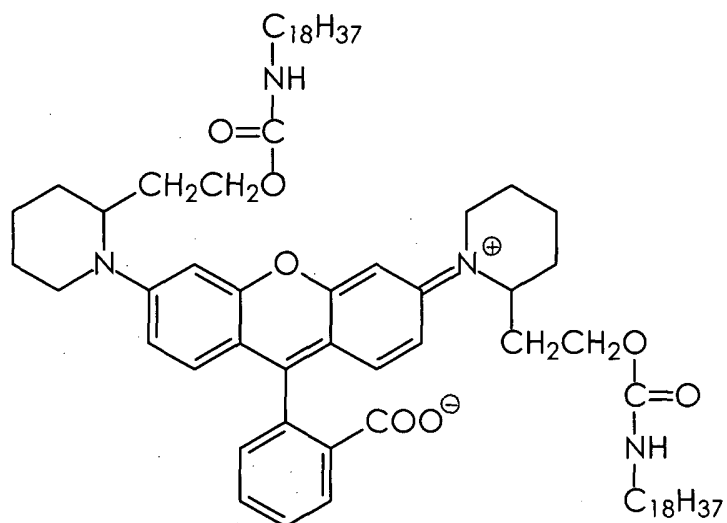
wherein n is at least about 12.

67. A compound according to claim 1 wherein the chromogen is of the formula

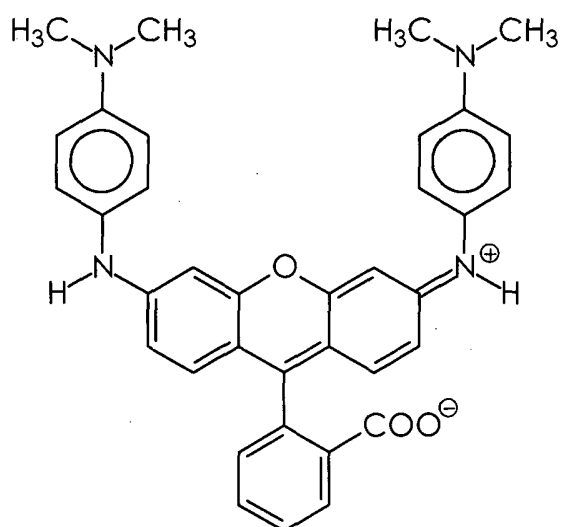


wherein n is at least about 12.

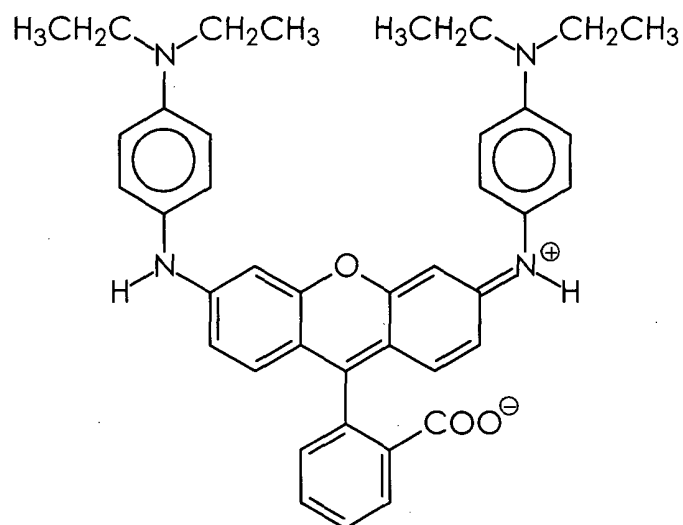
68. A compound according to claim 1 wherein the chromogen is of the formula



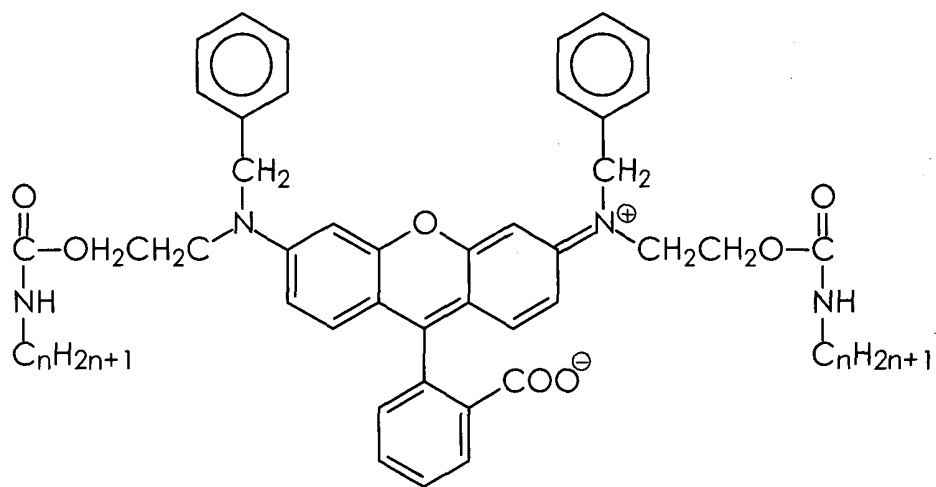
69. A compound according to claim 1 wherein the chromogen is of the formula



70. A compound according to claim 1 wherein the chromogen is of the formula

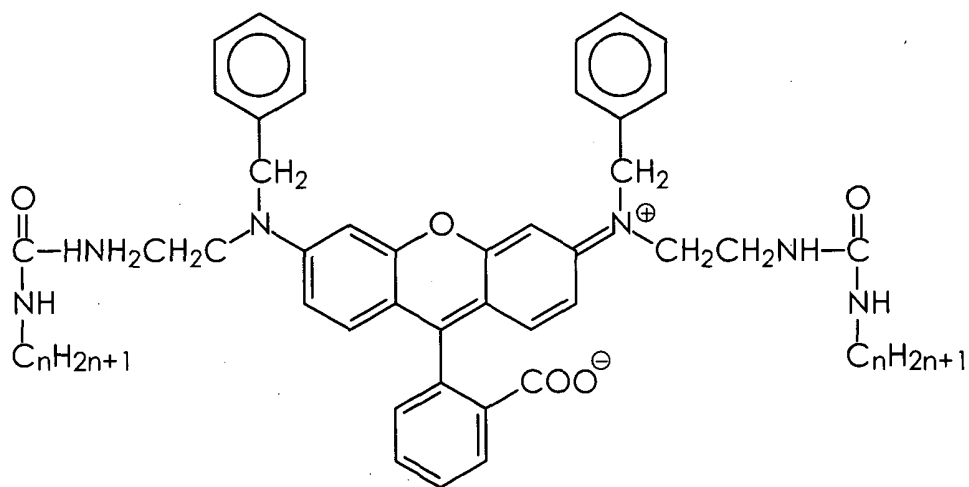


71. A compound according to claim 1 wherein the chromogen is of the formula



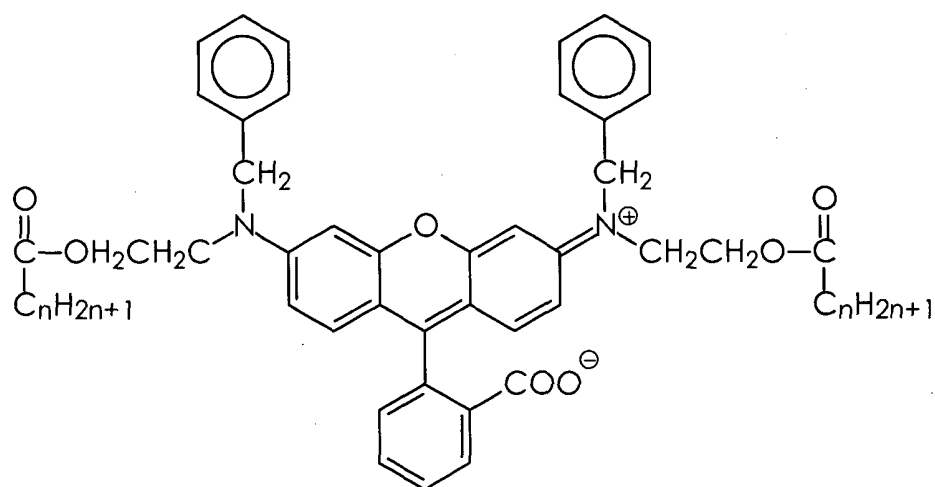
wherein n is at least about 12.

72. A compound according to claim 1 wherein the chromogen is of the formula



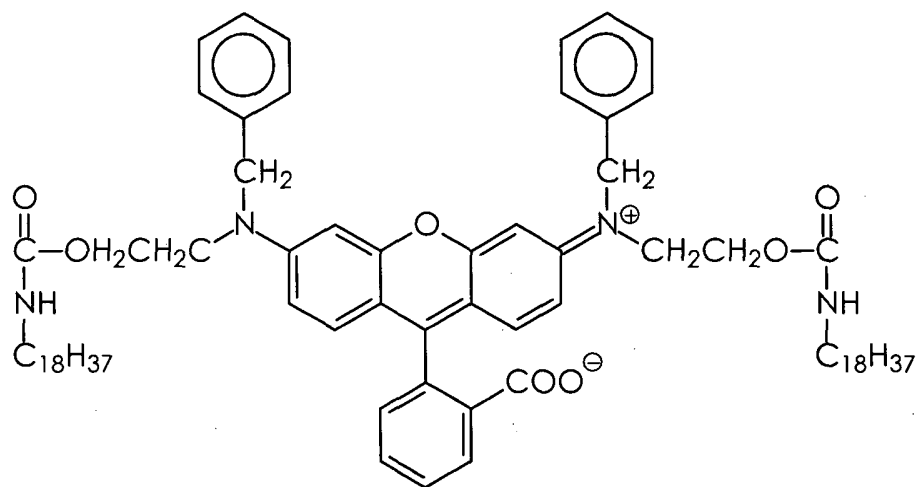
wherein n is at least about 12.

73. A compound according to claim 1 wherein the chromogen is of the formula

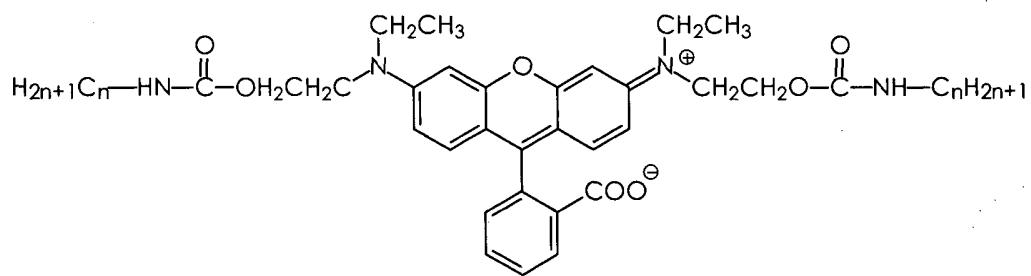


wherein n is at least about 12.

74. A compound according to claim 1 wherein the chromogen is of the formula

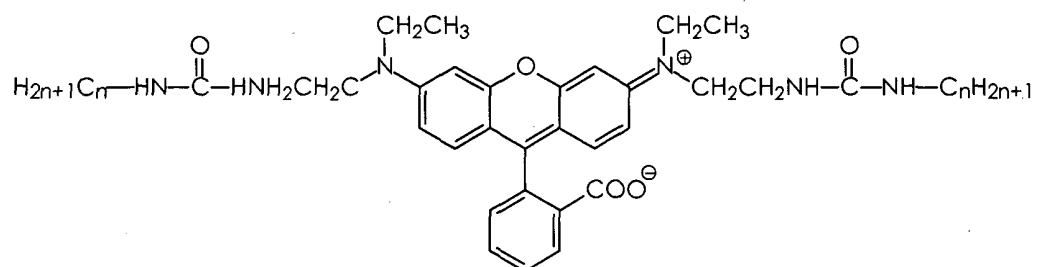


75. A compound according to claim 1 wherein the chromogen is of the formula



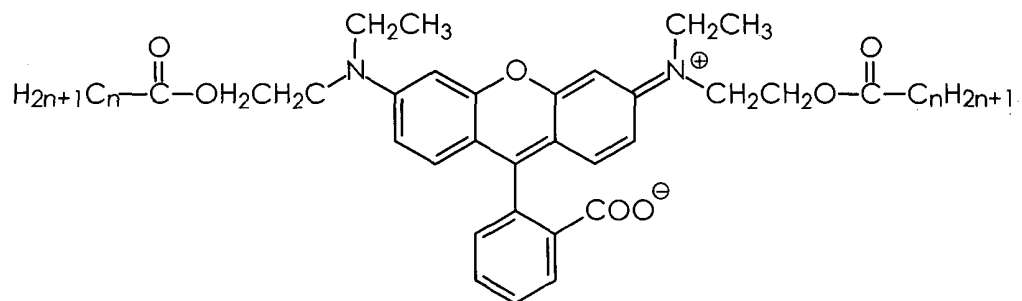
wherein n is at least about 12.

76. A compound according to claim 1 wherein the chromogen is of the formula



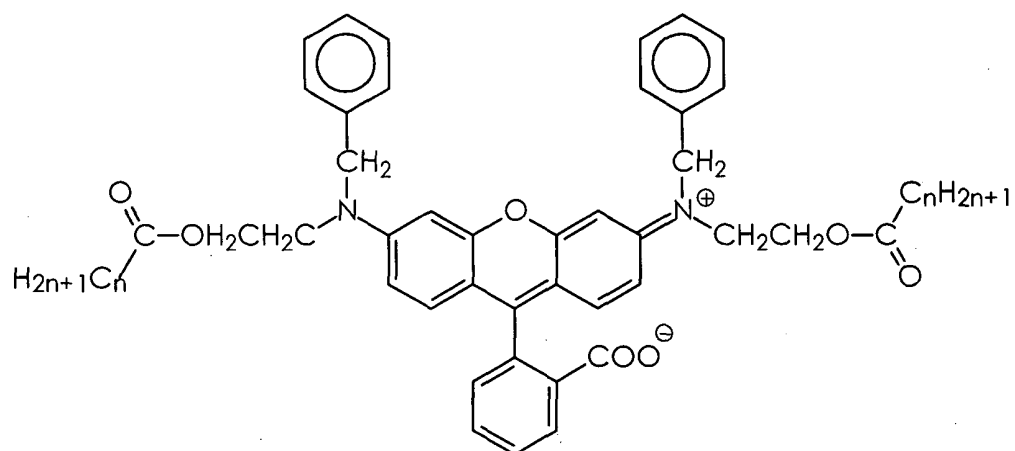
wherein  $n$  is at least about 12.

77. A compound according to claim 1 wherein the chromogen is of the formula



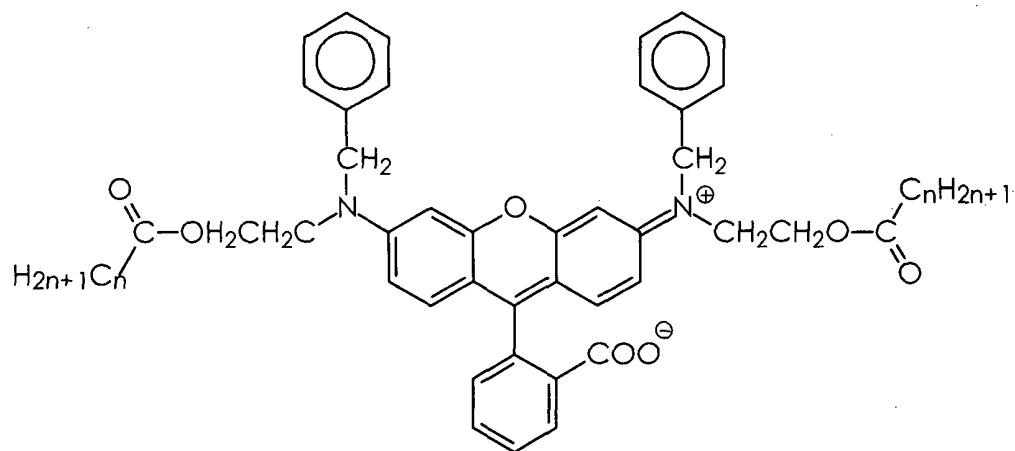
wherein  $n$  is at least about 12.

78. A compound according to claim 1 wherein the chromogen is of the formula



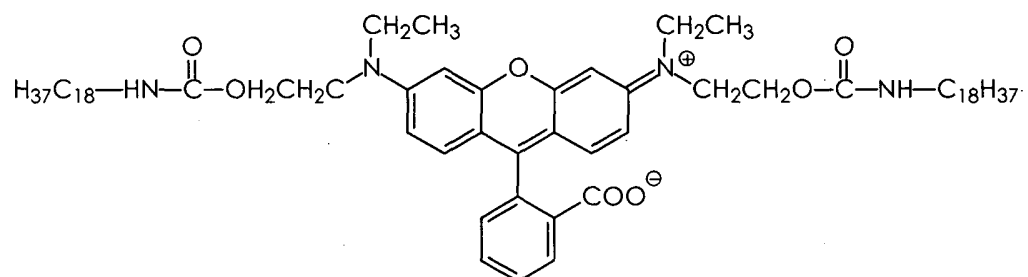
wherein n has an average value of at least about 12.

79. A compound according to claim 1 wherein the chromogen is of the formula

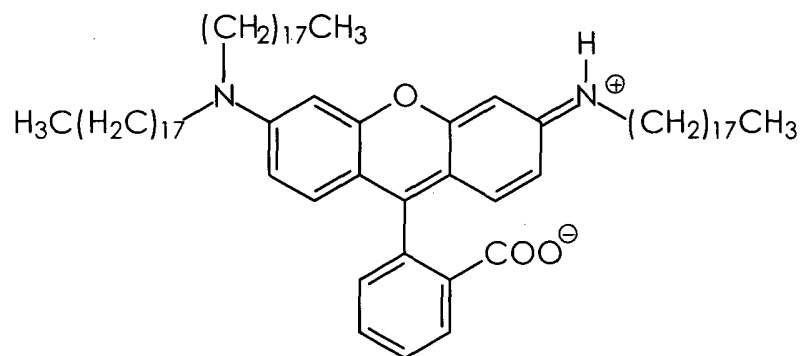


wherein n has an average value of about 50.

80. A compound according to claim 1 wherein the chromogen is of the formula

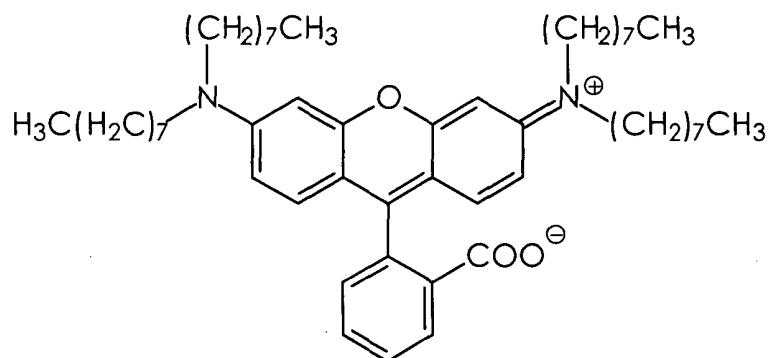


81. A compound according to claim 1 wherein the chromogen is of the formula

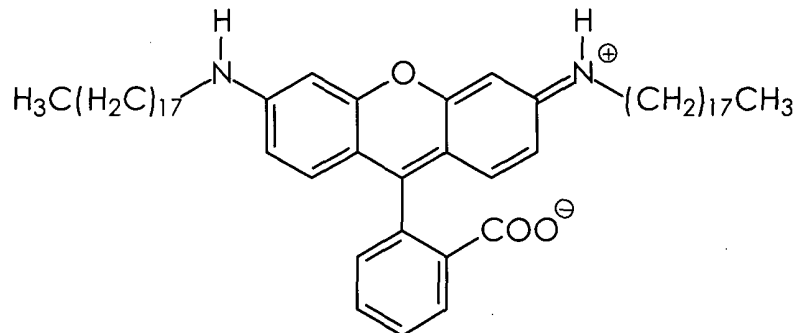




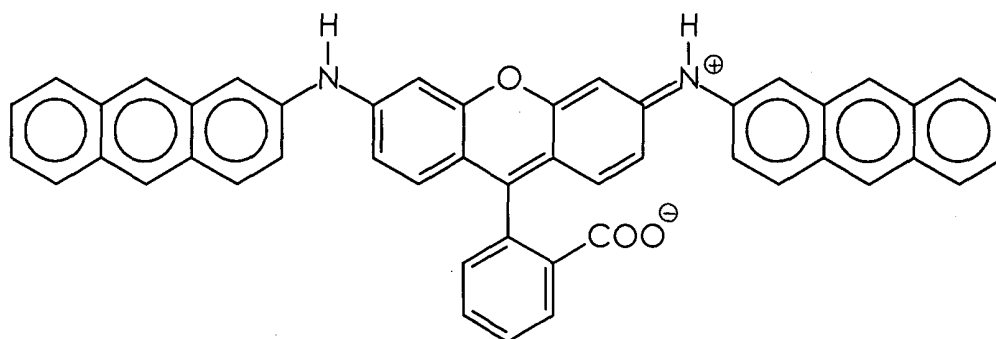
82. A compound according to claim 1 wherein the chromogen is of the formula



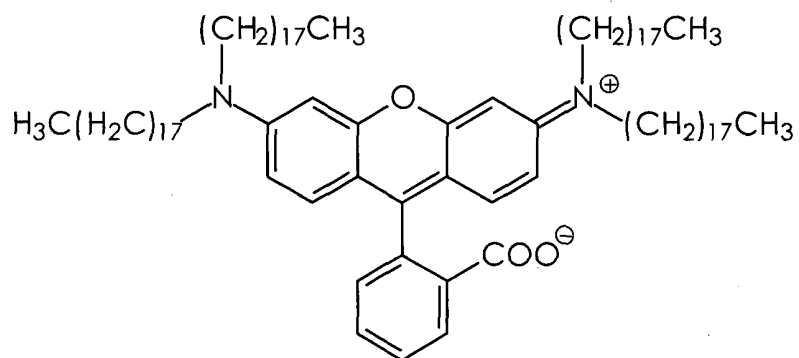
83. A compound according to claim 1 wherein the chromogen is of the formula



84. A compound according to claim 1 wherein the chromogen is of the formula

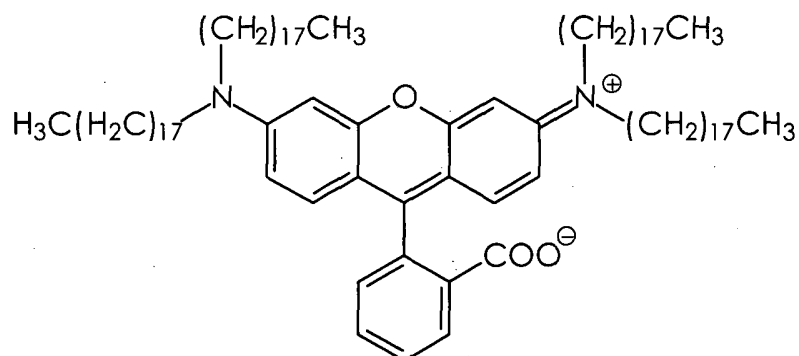


85. A compound according to claim 1 wherein M is a zinc cation, y is 2, and the chromogen is of the formula



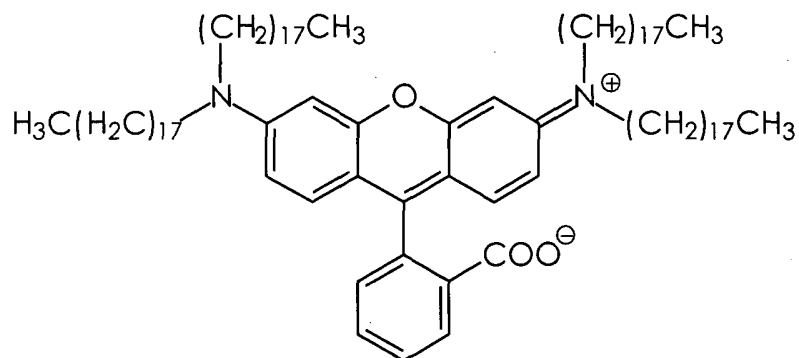
86. A compound according to claim 85 wherein z is 2.

87. A compound according to claim 1 wherein M is a calcium cation, y is 2, and the chromogen is of the formula



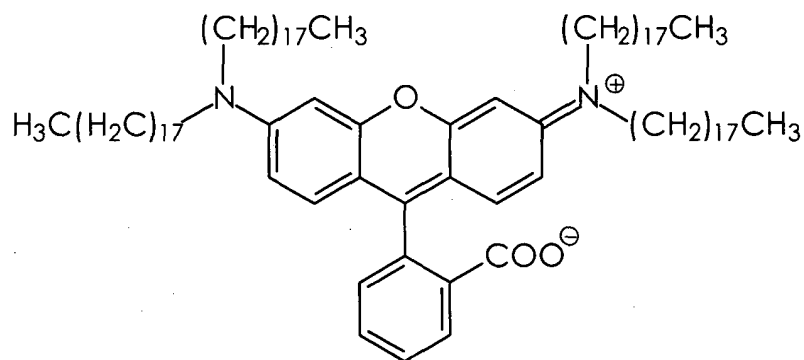
88. A compound according to claim 86 wherein z is 2.

89. A compound according to claim 1 wherein M is a bismuth cation, y is 3, and the chromogen is of the formula



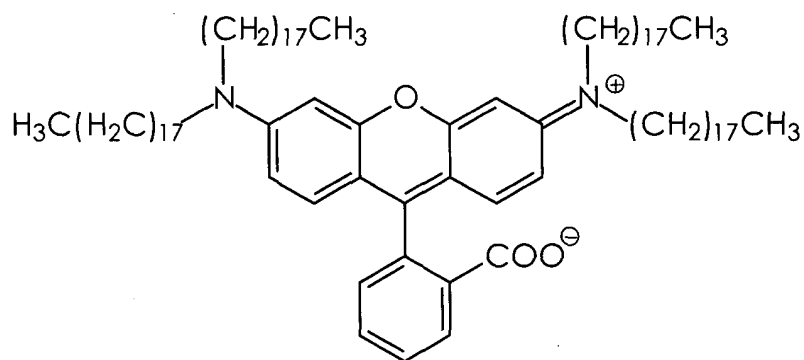
90. A compound according to claim 89 wherein z is 3.

91. A compound according to claim 1 wherein M is a tin cation, y is 2, and the chromogen is of the formula



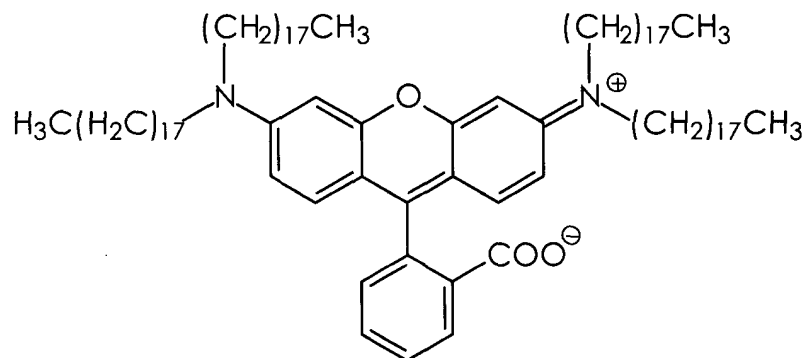
92. A compound according to claim 91 wherein z is 2.

93. A compound according to claim 1 wherein M is an iron cation, y is 2, and the chromogen is of the formula



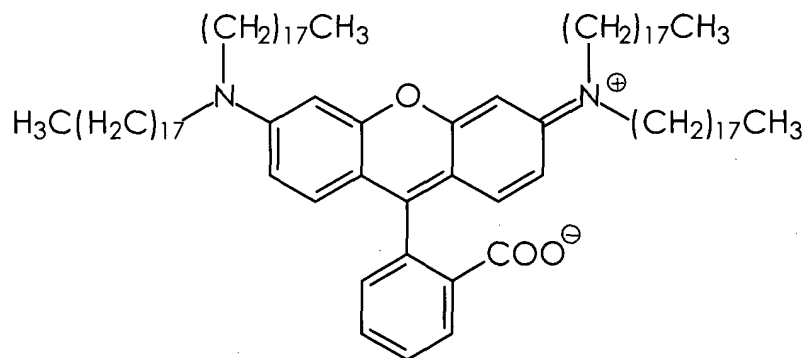
94. A compound according to claim 93 wherein z is 2.

95. A compound according to claim 1 wherein M is a copper cation, y is 2, and the chromogen is of the formula



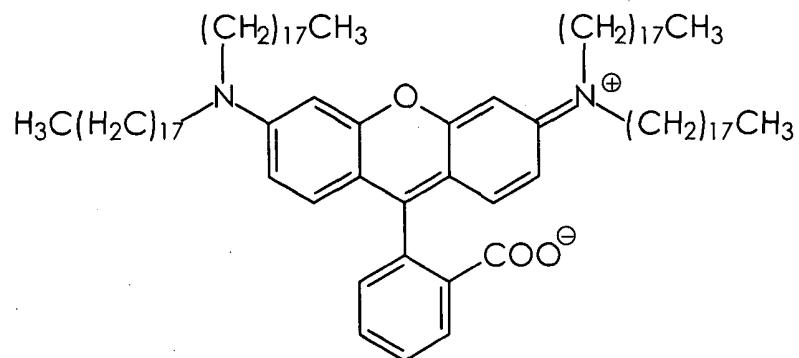
96. A compound according to claim 95 wherein z is 2.

97. A compound according to claim 1 wherein M is an aluminum cation, y is 3, and the chromogen is of the formula



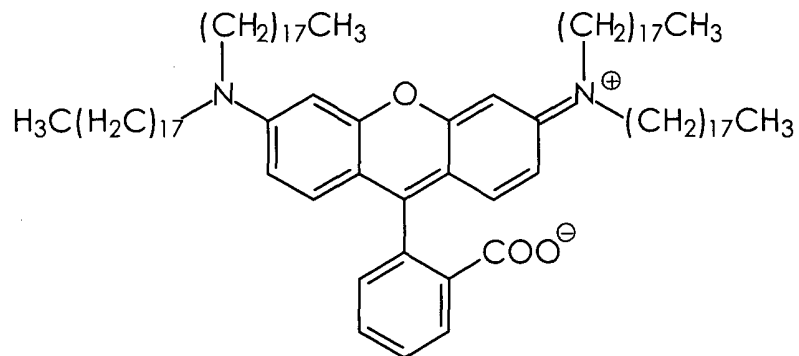
98. A compound according to claim 97 wherein z is 3.

99. A compound according to claim 1 wherein M is a nickel cation, y is 2, and the chromogen is of the formula



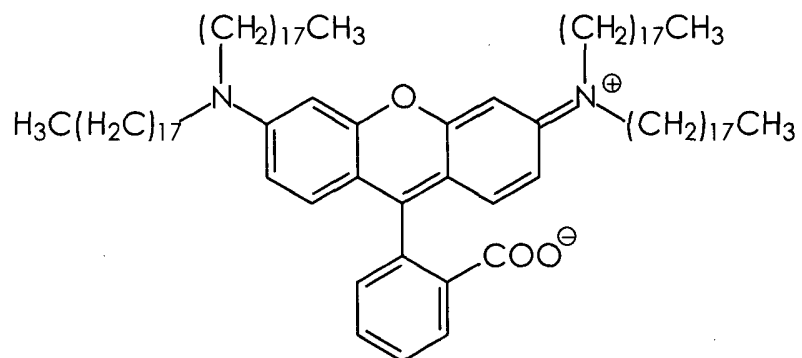
100. A compound according to claim 99 wherein z is 2.

101. A compound according to claim 1 wherein M is a titanium cation, y is 4, and the chromogen is of the formula



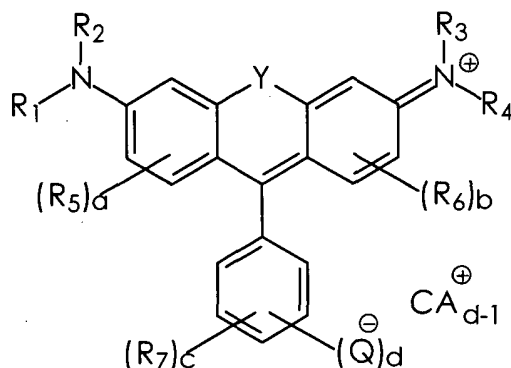
102. A compound according to claim 101 wherein z is 4.

103. A compound according to claim 1 wherein M is a chromium cation, y is 3, and the chromogen is of the formula



104. A compound according to claim 103 wherein z is 3.

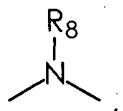
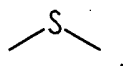
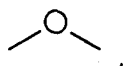
105. A compound comprising the reaction product of (a)  
a chromogen of the formula



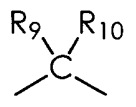
wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, wherein R<sub>1</sub> and R<sub>2</sub> can be joined together to form a ring, wherein R<sub>3</sub> and R<sub>4</sub> can be joined together to form a ring, and wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> can each be joined to a phenyl ring in the central structure, a and b each, independently of the others, is an integer which is 0, 1, 2, or 3, c is an integer which is 0, 1, 2, 3, or 4, each R<sub>5</sub>, R<sub>6</sub>, and R<sub>7</sub>, independently of the others, is (i) an alkyl group, (ii) an aryl group, (iii) an arylalkyl group, (iv) an alkylaryl group, (v) a halogen atom, (vi) an ester group, (vii) an amide group, (viii) a sulfone group, (ix) an amine group or ammonium group, (x) a nitrile group, (xi) a nitro group, (xii) a hydroxy group, (xiii) a cyano group, (xiv) a pyridine or pyridinium group, (xv) an ether group, (xvi) an aldehyde group, (xvii) a ketone group, (xviii) a carbonyl group, (xix) a thiocarbonyl group, (xx) a sulfate group, (xxi) a sulfide group, (xxii) a sulfoxide group, (xxiii) a phosphine or phosphonium group, (xxiv) a phosphate group, (xxv) a mercapto group, (xxvi) a nitroso group, (xxvii) an acyl group, (xxviii) an acid anhydride group, (xxix) an azide group, (xxx) an azo group, (xxxi) a



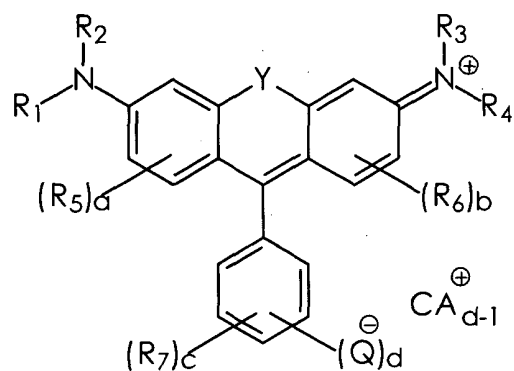
cyanato group, (xxxii) an isocyanato group, (xxxiii) a thiocyanato group, (xxxiv) an isothiocyanato group, (xxxv) a urethane group, or (xxxvi) a urea group, wherein  $R_5$ ,  $R_6$ , and  $R_7$  can each be joined to a phenyl ring in the central structure,



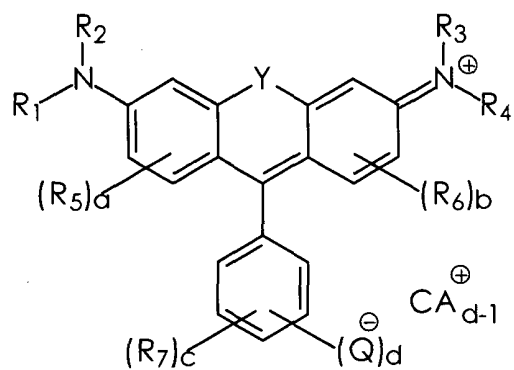
or



$R_8$ ,  $R_9$ , and  $R_{10}$  each, independently of the others, is (i) a hydrogen atom, (ii) an alkyl group, (iii) an aryl group, (iv) an arylalkyl group, or (v) an alkylaryl group, provided that the number of carbon atoms in  $R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}$  is at least about 16,  $Q^-$  is a  $\text{COO}^-$  group or a  $\text{SO}_3^-$  group,  $d$  is an integer which is 1, 2, 3, 4, or 5,  $A$  is an anion, and  $CA$  is either a hydrogen atom or a cation associated with all but one of the  $Q^-$  groups, and (b) a metal salt of which the metal portion is either (1) a metal ion having a positive charge of  $+y$  wherein  $y$  is an integer which is at least 2, said metal ion being capable of forming a compound with at least two



chromogen moieties, or (2) a metal-containing moiety capable of forming a compound with at least two



chromogen moieties.